

BEFORE THE HEARINGS PANEL

IN THE MATTER OF The Resource Management Act 1991, The
Proposed Porirua District Plan

AND District Wide Matters - Notable Trees Chapter

Between Submitter Jez Partridge
And Respondent Porirua City Council

STATEMENT OF EVIDENCE OF

Jeremy (Jez) Partridge

Dated: 18 November 2021

TABLE OF CONTENTS

1	INTRODUCTION	3
1.1	Code of Ethics	3
1.2	Qualifications and Experience	3
2	SCOPE OF EVIDENCE	5
3	EXECUTIVE SUMMARY	5
4	NOTABLE TREE ROOT PROTECTION	7
4.1	Background to root protection, issues, methods, and standards.....	7
4.2	Removal of the 'whichever is the greater' caveat	8
4.3	Broader problems with the 'dripline half height' method.....	9
4.4	Root Protection Areas and modified root systems	10
4.5	An improved method for estimating the location of important roots.....	11
4.6	Root Protection Areas and restricted root systems	12
4.7	Construction and development within the RPA	13
4.8	Which of the two methods produces the larger RPA?.....	14
4.9	Councils using the '12 times stem diameter' method in New Zealand	14
4.10	Analysis of Section 32 Report references to root protection methods	15
4.11	Analysis of Section 42a Report references to root protection methods	15
5	SOIL EXTRACTION METHODS WITHIN THE ROOT PROTECTION AREA	18
6	MINIMUM QUALIFICATION LEVEL FOR A TECHNICIAN ARBORIST	18
7	CHOOSING A SUITABLE STEM THRESHOLD	20
8	PERMITTED ACTIVITIES WITHIN THE ROOT PROTECTION AREA	20
9	SUMMARY TABLE OF RELIEF SOUGHT	21
	APPENDICES	22
	Appendix 1 – BS5837 1991 tree and root protection methods	22
	Appendix 2 – Examples of Councils using the BS5837 1991 root protection method including the 'whichever is greater' caveat in their District Plans	22
	Appendix 3 – Example of Notable Tree in Porirua with large RPA	22
	Appendix 4 – Hydrovac versus Airvac information/advertorial from Tree Matters magazine (NZ arb association) 2020	22
	Appendix 5 - Spreadsheet – RPAs compared for 159 trees in Porirua against 'dripline or half height' or '12 times stem diameter methods.	22

1 INTRODUCTION

1.1 Code of Ethics

1. I have read the Code of Conduct for Expert Witnesses (Section 7 of the Environment Court Consolidated Practice Note 2014) and I agree to comply with this Code of Conduct. This evidence is within my area of expertise, except where I state I am relying on what I have been told by another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

1.2 Qualifications and Experience

2. My full name is Jeremy Thomas Elliston Partridge. I currently run my own business Treecology Tree Consultancy where I am the Senior Consulting Arborist. Treecology provides planning advice, tree management advice, safety and risk assessments, STEM assessments, Plan Changes and all types of expert arboricultural advice to a wide range of clients including councils, businesses, colleges, and schools.
3. I have around 25 years of experience working in the arboricultural sector as a Climbing Arborist, Council Tree Officer, and Consultant Arborist. I worked as a Climbing Arborist in the UK for Brighton and Hove Council, and then an Arboricultural Officer and Senior Arboricultural Officer for Anglesey County Council, Poole Borough Council, and North Dorset District Council. My duties at these Councils included management and determination of protected tree planning applications, making Tree Preservation Orders, and assessing applications to undertake construction and development in proximity to protected trees.
4. UK Councils use British Standard 5837 Trees in Relation to Construction (BS5837) as a reference guide and minimum standard when considering application to undertake works which may affect the roots of protected trees. I am therefore well versed in the use of this standard and its technical specifications. I was also involved in the update of BS5837 in 2005 when the method moved away from using the 'drip line or half height method' to determine the area of roots which should be protected to the '12 times stem diameter method'. I thus have a good understanding of the application and effects of these tree root protection methodologies.
5. I moved to New Zealand in 2007 and worked at Hutt City Council for around four years in their Resource Consents Department as a Monitoring and Enforcement Officer. In this role I also advised the Resource Consents Team on Notable and protected tree issues, and assessed applications to undertake work to, or in proximity to protected trees. In this role I became

familiar with the Resource Management Act (RMA) and Notable Tree rules, methods, and procedures.

6. My business Treecology Tree Consultancy has been in operating since 2009 on a part time basis and since 2015 on a full time basis. A large part of my business is providing advice and report to both Councils and developers in respect of resource consent applications to undertake work to or close to protected trees and often Notable Trees. I am thus well used to dealing with applications to undertake works relating to the protected root systems of trees. The advice I provide on the protection of trees and their roots will align with each Council's District Plan rules, though I recommend use of relevant International Standards where possible in accordance with NZ Arboricultural Association recommendations.
7. I am currently studying the Level 6 Diploma in Arboriculture at Wintec College, Hamilton which I will complete in December 2021. I hold a Level 4 Arboriculture Award from Myerscough College, UK (2020). I am an International Society of Arboriculture (ISA) Certified Tree Risk Assessor (TRAQ Certified). I have been trained in Quantified Tree Risk Assessment though my certification is not current. I hold the Craftsman's Certificate in Tree Surgery from Merrist Wood Agricultural College, UK (1991), a Higher National Diploma (degree) in Environmental Protection from Farnborough College of Technology, UK (1995), and a Master of Science degree in Rural Resource Management from Bangor University in Wales (1997). I have also attended a large number of workshops, training events and seminars on professional arboriculture.
8. I am a member of NZ Arboricultural Associations and have sat on two of its sub-committees. I have been co-convenor of Greytown Tree Advisory Group since 2015 which advises the Greytown Community Board on a range of tree and Notable Trees matters.
9. I have recently completed a research investigation of Notable Tree root protection methods and related District Plan rules used by every Territorial Authority in New Zealand. The results of this study will be presented at the NZ Arboricultural Association Conference in 2022. I consequently have a large dataset of information on this topic and through this investigation have acquired a detailed understanding of root protection methodologies and related District Plan rules and definitions used in New Zealand.

2 SCOPE OF EVIDENCE

10. I have prepared this evidence as a professional consultant arborist because I take an interest in the Notable Tree Chapters of every District Plan in New Zealand. I am keen to see best practice methods used to protect Notable Trees across New Zealand.
11. In preparing this evidence, I have read the following documents:
 - Proposed DP Notable Tree Chapter Policies, Objectives, Rules, Definitions, and Schedule of Notable Trees
 - Section 32 Report sections on Notable Trees informed by Arborlab
 - Section 42a Report on Notable Trees
 - Statement of Expert Evidence by Leon Saxon and David Spencer.
12. Abbreviations: RPA – Root Protection Area, TPZ – Tree Protection Zone, CRZ – Critical Root Zone, SELN – Statement of Evidence by Leon Saxon, BS5837 – British Standard 5837 Trees in relation to design, demolition and construction, AS4970 – Australian Standard 4970 – Protection of Trees on Development Sites, ANSI A300 – American Standard A300 Management of Trees and Shrubs During Site Planning, Site Development, and Construction. RMA – Resource Management Act, TRAQ – Tree Risk Assessment Qualification, QTRA – Quantified Tree Risk Assessment, VALID – Tree Risk Benefit Management Strategy, DP – District Plan, Council – Porirua Council.

3 EXECUTIVE SUMMARY

13. Porirua Council (Council) has not previously had a Notable Tree Chapter in its District Plan, unlike the majority of District Councils in NZ which already protect Notable (or other termed) Trees using section 76 of the RMA. This Plan Change therefore represents a unique opportunity for Council to apply modern best practice methods of tree protection practice in its District Plan. I concur with Council that the Notable Trees and their root system require a high level of protection via District Plan Rules.
14. Council has proposed to use the 'dripline or half height method' to determine the area of important structural and feeding roots where the District Plan should control the extent or type of works or activities which can be undertaken to a tree's roots. This method was first used by British Standard 5837 Trees in Relation to Construction in 1991. However, in the 2005 BS5837 the method was withdrawn and replaced by the '12 times stem diameter' method.
15. The 'dripline half tree height' method proposed to be used by Council to determine the extent of a Notable Tree's Root Protection Area (RPA) was withdrawn by BS5837 in 2005 as it

contained inherent faults which made it unreliable. It has the potential to lead to loss of important feeding or structural roots, encourage inappropriate tree-building relationships which threaten trees, and favours columnar trees in respect of the size of an RPA. It is also difficult for a layperson to use, and lacks the flexibility required to take account of below ground root restrictions. I am therefore of the opinion that the most appropriate RPA definition for Council to use is the '12 times stem diameter' method as recommended by the NZ Arboricultural Association, and also the British, American, and Australian trees and construction National Standards.

16. Council has proposed allowing excavation within the RPA of Notable Trees using the hydrovac soil extraction method. I agree with Council's expert arboricultural consultant that 'hydro-excavations can strip the bark from roots, causing damage to the cambium and therefore the flow of water and nutrients between the roots and the canopy'. Airvac soil extraction methods on the other hand are benign to roots, and do not cause significant damage to them. I am therefore of the opinion that the most appropriate soil extraction method for Council to allow within RPAs is the Airvac method, and that consequently reference to the hydrovac method should be removed from the District Plan.
17. Council has proposed a requirement that only a minimum Level 6 qualified Arborist is able to make a decision as to whether a tree is dead, dangerous, or unsafe. In my experience, this level of arboricultural competence is taught at the Level 4 arboriculture qualification level or below. In this respect, requiring a tree owner or manager to have to go to the additional expense of contracting in a Level 6 Arborist to confirm this matter is unreasonably onerous and expensive. I am therefore of the opinion that the provision should be removed from the District Plan.
18. As regards permitted activities within the RPA, in my opinion these should all be discretionary as there is potential for considerable damage to be caused to tree roots if all roots with a diameter of 35mm or less are allowed to be removed without resource consent, and hydrovac also. A Level 6 Arborist should initially prepare an Arboricultural Method Statement to set requirements as to soil extraction methods and root pruning standards based on the tree species and the extent of its root system. For these reasons I am of the opinion that all activities within the RPA of a Notable Tree should be a discretionary activity as is the case in many other District Plan.

4 NOTABLE TREE ROOT PROTECTION

4.1 Background to root protection, issues, methods, and standards

19. Roots are vital for viability and stability of trees and if roots are torn, fungal spores can get in through the wounds, some of which have the potential to severely weaken or kill a tree. Roots not only take up water, minerals, and nutrients but also absorb oxygen, and if soil is sufficiently compacted tree roots may die. For all these reasons and more it is important for root systems to be preserved and protected where possible. Trees can cling to life despite wounds, damage, and inhospitable conditions, but their health and condition will decline to the point that they will eventually die prematurely and their aesthetic values will be gone forever. I therefore concur with Council on the need to protect the roots of Notable Trees.
20. Trees are frequently damaged when construction or development occurs too close to them through activities such as new footpaths and roads, vehicles compacting soils over roots, underground services trenches, and building foundations. The need to protect the canopies, stems (trunks), and roots of protected trees has long been understood. One of the first National Standards which aimed to guide industry and developers on the protection of trees on construction sites was British Standard 5837 first published in 1980.
21. In 1991 the second edition of BS5837 - Trees in Relation to Construction was published and this provided detailed guidance on the critical area of a root system where roots should ideally be preserved. The area of roots to be protected were referred to as the 'exclusion zone' and guidance was provided as to how the extent of these zones should be determined (see Appendix 1). Two methods were promoted in this Standard, in the first method (table 1) a circular exclusion zone was calculated around a tree (based on a radius generated by the table) dependent on its age class, vigour class, and which stem diameter group it was in. Guidance in Table 1 also states '*other considerations particularly the need to provide adequate space around the tree including allowances for future growth and also working space will usually indicate that structures should be further away*'. This consideration is important as it indicates that the extent of the Exclusion Zone is the starting point for determining where construction should be allowed and not the limit. The second method shown in Figure 2 of BS5837 1991 (Appendix 1) was an alternative truncated method which used either the extent of a tree's spread/dripline of a tree or half of its height (whichever was greater) to determine the extent of the tree and root protection radius/exclusion zone where protective fencing should be positioned.
22. The alternative method from BS5837 (dripline or half height method) subsequently became the default method in the UK for determining the 'tree exclusion zone' (TEZ). The reason the

Table 1 method fell out of favour was mainly because it is not always straightforward to accurately assess the age class of a tree, vigour can be disputed, and the stem diameter bands meant that trees at the lower or higher band ends could unfairly receive disproportionately more or less protection.

23. During my time as a Council Arboricultural Officer in the UK up to 2005 I used the BS5837 Figure 2 'dripline half height' method to determine tree exclusion zones for protected trees. The 'dripline half height' method became embedded as standard practice in the UK, and it is no surprise then that it migrated to New Zealand in the early to mid-1990's due to many arborists moving back and forth for work and study between the two countries. In NZ the 'dripline half height' method was gradually adopted into District Plans to determine an area around a Notable Tree where certain activities were not considered a permitted activity under an RMA District Plan. Whilst District Plan rules were used to restrict certain types of tree work, the dripline or half height method was used to inform as to where works to tree roots were not a permitted activity.
24. The original BS5837 1991 figure 2 illustration is still found in a number of District Plans today, or an updated copy of the original. For example, Wellington City Council's Operative District Plan contains the original illustration and the Operative Combined Wairarapa Councils District Plans contains a faithful copy of the original (see Appendix 2). The BS5837 1991 alternative Figure 2 method can be summarised as follows: The Tree Exclusion Zone where protective fencing should be positioned should be located at the extent of a tree's branch spread or at a distance equal to half the height of the tree, whichever is the greater distance.

4.2 Removal of the 'whichever is the greater' caveat

25. It is important to note that the original BS5837 Figure 2 illustration includes the caveat 'whichever is the greater' when it refers to application of either the half height or canopy extent of a tree to determine the location of important roots that should be preserved. The caveat is a very important part of the method as if it is removed large columnar trees receive disproportionately large Tree Exclusion Zones as compared to a spreading tree of a similar height. For example, if a Norfolk Island Pine tree has a height of 30 metres and a widest canopy spread on one side of 8 metres, it is given a 15m RPA radius using the 'dripline half height' method (Porirua Council's proposed RPA definition). The Norfolk Island Pine therefore has an RPA which extends 7 metres beyond the furthest extent of its canopy. This a very large RPA which encompasses places where there may be no tree roots, and within the 15m RPA development could potentially be declined. However, for a 30 metre high spreading eucalyptus

tree with a widest crown extent of 10 metres, its RPA radius extent would only extend to the canopy edge at 10 metres. In this case construction could proceed without the need for a resource consent to the point where a building could almost be almost touching the tree's canopy. In this scenario important roots could potentially be damaged, there is no allowance for any future growth, and if a dwelling is allowed right up against the canopy edge this could lead to applications to fell the tree or to regularly restrict its growth.

26. The proposed definition of a Root protection Area (RPA) as part of Porirua Council's proposed District Plan is an example of a plan where the 'whichever the greater' caveat has been removed. In my opinion, the removal of this caveat has the potential to cause unintended and perverse outcomes.

4.3 Broader problems with the 'dripline half height' method

27. In the UK BS5837 is often used and/or required to be adhered to in a Planning Condition, and therefore the standard's wider recommendations regarding the potential for retaining roots beyond a nominal root protection area can be specified by a Council. In NZ District Plans, root protection is generally much more prescribed. For example permitted activities which have the potential to significantly harm the root system of a tree are allowed regardless of whether a root system is restricted or modified.
28. Terms used to describe an area of protected roots in a District Plan vary considerably and include Root Protection Area, Tree Protection Zone, and Protected Root Area. The type and extent of works that can be undertaken to tree roots within RPAs/TPZs/PRA's also vary considerably from being fully discretionary, non-complying, restricted discretionary, or permitted. For example, in the Taupo District Plan activities within 5 metres of the base of a Notable Tree are a non-complying activity. The absence of an NZ Trees and Construction Standard in NZ and the differing advice of arborists to Councils on this matter has led to a wide range of often conflicting root protection requirements between Councils. It is possible for Council's to recommend adherence to International Standards in their District Plans such as Upper Hutt City Council with Australian Standard AS 2187.2 1993 and AS 2187.2 1993. The NZ Arboricultural Association supports the use of three International Trees and Construction Standards on its website (<https://www.nzarb.org.nz/safety-and-guidelines>).
29. For columnar trees and spreading trees use of the 'dripline half height' method to determine a Root Protection Area radius is essentially a rule of thumb as to where important roots may be located. For tall columnar trees a huge RPA could be generated as large as 20 metres or more for trees with a height of 40 metres plus, and within this RPA there may be few or any roots

towards the RPA outer edge. For spreading trees critical roots have the potential to exist beyond the canopy spread of a tree, and the '12 times stem diameter' method more frequently places the RPA extent outside the canopy extent (see Appendix 5 spreadsheet).

30. The term 'spreading tree' is not used commonly in arboriculture. In BS5837 1991 it is used just to differentiate between columnar trees (which is a regularly used arboricultural term) and all other trees. For trees which are not considered columnar such as lime, ash, totara, and gum their height often exceeds their spread up to maturity (or earlier) when their spread may then meet or exceed their height. This can create a problem when an aged 'spreading tree' is wider than it is tall as in this scenario the RPA extent will extend only as far as the dripline. This can cause problems because important roots may be removed or torn outside the canopy, and because buildings can be positioned very close to trees. Another issue is that for some tree species, deciding whether they are columnar or spreading is not straightforward especially when a variety of a particular tree species is being assessed.
31. Both BS5837 2012 and AS4970 2009 have a cap on the extent of the maximum RPA or TPZ. AS4970 advises that the maximum extent of the TPZ radius is 15 metres, and BS5837 advises that the maximum area of the RPA is 707m² (equal to a circle with a radius of 15m). The 'dripline half height' method has no cap and therefore circular radii have the potential to be much larger than actually required. Trees grow larger year on year until mature and consequently the extent of the RPA whether determined by the extent of its canopy, height, or stem diameter will increase regardless of the method used to calculate the RPA, and a RPA calculation will only be needed if a an activity requiring consent is proposed within its RPA.
32. In my opinion, the 'dripline half height' method has many faults which means that it doesn't work well consistently, and these problems are made considerably worse if the 'whichever is the greater' caveat is removed. All these issues are essentially the reason why the 'dripline half height' method was abandoned internationally from the late 1990's, and superseded by the improved '12 times stem diameter' method.

4.4 Root Protection Areas and modified root systems

33. For trees which have modified root systems (not equally spread in all directions) in urban areas the project arborist may want to recommend a change the shape of the circular root protection area to protect important roots, and this is allowed using BS5837 2012. Council's RPA definition only extends as far as the dripline for a spreading tree and so extending the RPA beyond the dripline to take account of a modified RPA is not possible. The '12 times stem diameter' method which often extends beyond a tree's dripline would provide for more

flexibility to protect the location of actual roots as opposed to the assumed location of roots. BS5837 2012 provides the following advice on this issue in paragraph 4.6.2: *The RPA for each tree should initially be plotted as a circle centred on the base of the stem. Where pre-existing site conditions or other factors indicate that rooting has occurred asymmetrically, a polygon of equivalent area should be produced. Modifications to the shape of the RPA should reflect a soundly based arboricultural assessment of likely root distribution.*

4.5 An improved method for estimating the location of important roots

34. In 2005 the third version of BS5837 was issued which included improved guidance on calculating root protection areas, and I used this method in the UK as an Arboricultural Officer from 2005 onwards. BS5837 2005 introduced the '12 times stem diameter' method to determine a 'Root Protection Area' which should normally should be preserved when construction occurs close to a tree. This updated root protection guidance was based on an improvement of the BS5837 1991 Table 2 stem diameter method, and upon research undertaken by two internationally respected arborists from the USA, Matheny N., and Clark J. who produced *Trees and Development: A Technical Guide to the preservation of trees during land development*, International Society of Arboriculture, 1998, and since then subsequent versions have retained this method. It was found that the '12 times stem diameter' method provided an improved representation of where roots critical for a tree's health and stability are usually found.
35. From the late 1990's onwards the '12 times stem diameter method' became accepted internationally as the best practice method to determine where the most important roots of a tree can be found, and which should be protected. The current International Trees and Construction Standards in which this method is recommended include British Standard 5837 2012, Australian Standard 4970 2009, and American National Standard: ANSI A300 (Part 5)-2012: Management of Trees and Shrubs During Site Planning. Each Standard has its own term for an area of protected roots. These being the *Root Protection Area (RPA)* for BS5837, the *Tree Protection Zone (TPZ)* in AS4970, and the *Critical Root Zone (CRZ)* in ANSI300. Regardless of the different terminology the Standards all recommend use of the '12 times stem diameter' method.
36. The NZ Arb Association states the following on its website: NZ Arb also supports and states the following on its website: *NZ Arb also supports and recommends the following international tree protection zones as: The Tree Protection Zone (TPZ) which is a circle taken from the centre of the trunk with a radius equal to 12 times the diameter of the trunk measured at 1.4m (DBH)*

above ground level. It also lists acceptance of the following International Standards: *Australian Standard: AS 4970 - 2009 Protection of Trees on Development Sites*, *British Standard: BS 5837:2012 Trees in relation to design, demolition and construction*, and *American National Standard: ANSI A300 (Part 5)-2012: Management of Trees and Shrubs During Site Planning, Site Development, and Construction.* The NZ Arb Association's endorsement of the '12 times stem diameter' method to calculate the RPA is unequivocal.

37. In my opinion the endorsement of the 12 times stem diameter method for root protection by USA, UK, and Australian Standards, and the NZ Arboricultural Association should be sufficient evidence for Porirua City Council to adopt this method to define the RPA of a Notable Tree, and to my best knowledge there is no current scientific basis or accepted arboricultural best practice evidence for Porirua City Council to adopt an RPA definition based a withdrawn version of BS5837 1991.
38. The '12 times stem diameter' method provides a reliable method for determining the area and location of important roots around a tree according to three International arboricultural standards. It is relatively simple method to use as by measuring a tree's diameter multiplying that diameter by 12, the radius of the root protection area is determined. The method could therefore easily be undertaken by a layperson using a tape measure and calculator. The 'dripline or half height' method is more difficult to use and apply because accurate assessment of tree height is required for which an arborist would require a clinometer or tree laser, and complicated mathematics may be needed for example if the tree is on the side of a hill. It also may be difficult for a layperson to determine what does or doesn't constitute a columnar or spreading tree and this may lead to mistakes.

4.6 Root Protection Areas and restricted root systems

39. Both the 'dripline or half' method and the '12 times stem diameter' method determine a nominal RPA/TPZ as a circle with the tree at its centre. Both methods therefore have the potential for the RPA to encompass underground structures or roots of other trees roots which may restrict the equal spread of the subject tree's roots. For example, for a spreading canopy tree growing in a berm 2 metres from the edge of a road on one side and 1 metre from a path on the other side with a 6 metres furthest canopy extent, the RPA (using Council's definition) would be a circle with a radius of 6 metres. The RPA would therefore encompass a road, a footpath and potentially other structures. It is very common for Notable Trees and other trees in urban areas to have underground structures or roots of other trees within their RPAs. The

method used to calculate a nominal circular RPA around a tree does not alter this. I provide a similar example in Appendix 3.

40. BS5837 2012 paragraph 4.6.3 provides the following advice for trees in the situation where their root systems have been modified by below ground obstructions: *Any deviation in the RPA from the original circular plot should take account of the following factors whilst still providing adequate protection for the root system: a) the morphology and disposition of the roots, when influenced by past or existing site conditions (e.g. the presence of roads, structures and underground apparatus); b) topography and drainage; c) the soil type and structure; d) the likely tolerance of the tree to root disturbance or damage, based on factors such as species, age, condition and past management.* In situations where Notable Tree root systems are modified, a Resource Consent application would likely require a report from an expert arborist who would consider this in their arboricultural impact assessment report.

4.7 Construction and development within the RPA

41. It is important to note that development may be acceptable within an RPA/TPZ and it is not necessarily a no-go zone unless the District Plan defines an activity as non-complying. For example, it may be possible to build an above ground permeable road which does not require a deep base course or soil compaction, and which therefore does not damage or impair the ability of tree roots to function. Cantilevered foundations or mini piles may also allow development within an RPA. The point is that development within the RPA/TPZ in the case of the Porirua Proposed District Plan is not a non-complying activity but is a restricted discretionary activity. Development within the RPA/TPZ therefore may be acceptable in some circumstances, especially where special engineering solutions to avoid damage to tree roots are proposed. Council has already stated in its matters of discretion that a 10% incursion of the RPA is acceptable, and in the example described in paragraph 32 the project arborist would need to take account of a tree which has already had its rooting area reduced by 30% or more, and also whether the Council's suggestion that the RPA may be reduced by a further 10% is appropriate.
42. In my opinion it is best for District Plans not to describe a generic 'acceptable' percentage of an RPA which can normally be reduced as in my experience this generally leads to applicants assuming that this will always be acceptable. In situations where roots are restricted within the RPA this type of allowance can make matters more complicated. However, the International Standards vary on this point. AS4970 prescribes the loss of 10% of a TPZ to be minor and therefore potentially acceptable, whereas BS5837 used to allow a 20% offset in the 2005

version but removed this guidance in the 2012 version as it was felt it was being abused. In my own opinion if a 10% reduction in the RPA is promoted then this 10% loss should be offset by viable roots elsewhere beyond the RPA extent.

4.8 Which of the two methods produces the larger RPA?

43. In my experience the '12 times stem diameter' method on average across a representative sample of tree species, ages, sizes and environmental conditions produces larger RPAs. A circular RPA using either method is a nominal area of protected roots where construction may be allowed under certain circumstances. A slightly larger RPA provides Council with more flexibility to ensure that important feeding roots beyond the canopy are not removed or damaged, account is taken of below ground root restrictions, and that dwellings are not situated right up close to the canopy edge of a large trees which could result in future pressure to remove or regularly cut back trees from buildings.
44. In the attached spreadsheet (Appendix 5) I have provided a copy of a Tree Survey I carried out in 2020 in Porirua, where I surveyed 159 trees for a developer. The trees are from a wide range of species including a variety of columnar and spreading trees, a wide range of ages and sizes, and a wide range of growing conditions from being root constrained by hard surfacing, canopy and root constrained by other trees, to open grown. Crown spreads, heights, and stem diameters have been used to calculate RPAs using the 'dripline half height' method preferred by Council and the '12 times stem diameter' method recommended by the NZ Arboricultural Association. The results are that of 112 of 159 trees attained larger RPAs using the '12 times stem diameter' method (approximately 70%). It is also noticeable that the differences between RPA radii for columnar trees using the 'dripline half height' method are proportionally larger than the rest of the dataset.

4.9 Councils using the '12 times stem diameter' method in New Zealand

45. A few NZ District Councils are currently using the '12 times stem diameter' method to determine the extent of the area of protected roots for Notable Trees e.g. Marlborough District Council, and other Councils are considering adopting this method. It is an interesting conundrum as to why more Councils in NZ are not using the '12 times stem' diameter method given that it is recommended by the NZ Arboricultural Association. I have spoken to a number of Council Officers about why the '12 times stem diameter' method was not taken up by their Council. I have been told anecdotally that Planning Teams are nervous about potentially requiring larger RPAs which may restrict development opportunities. In my opinion planners should not be nervous about this issue for two main reasons:

- 1) The 'dripline half height (whichever is the greater)' method can also generate very large RPAs for tall trees. These RPAs have the potential to be larger than those generated by the '12 times stem diameter' method, and;
- 2) The RPA is a nominal area of protected roots where roots may or may not be found to be present following advice from an arborist, and where no-impact, or low-impact construction techniques may allow development to occur.

4.10 Analysis of Section 32 Report references to root protection methods

46. The Section 32 Report makes no reference to evaluating an appropriate method to determine an area of roots of a Notable Tree where activities which may harm roots. There is also no evaluation of the costs and benefits of different root protection methods similar to the way in which options are discussed and compared for deciding on the most appropriate method used to decide whether trees should be made Notable. In my opinion, the Section 32 evaluation report did not examine whether the proposed Notable Tree protected root area method was the most appropriate way to achieve the Plan's objectives in relation to Notable Trees and the purpose of the RMA.
47. In my opinion, if the '12 times stem diameter' method had been robustly compared against the 'dripline half height' method in the Section 32 Report, the '12 times stem diameter' method should have been found to be the most appropriate method. The 'dripline half height' method chosen by Porirua Council is not supported by any International Arboricultural Trees and Development Standard, or recommended by the NZ Arboricultural Association.
48. Paragraph 27.1 of Mr Saxon's Statement of Evidence states that 'Consideration was given to recommending the use of one of the International Standards but was discounted in preference of the simpler method as proposed'. This statement is concerning as it appears that this consideration was not recorded within the Section 32 Report.

4.11 Analysis of Section 42a Report references to root protection methods

49. The Section 42a Report, in respect of responses to my submission on root protection areas, relies on the arboricultural supporting expert evidence of Leon Saxon of Arborlab Consultancy Services Ltd. I therefore will refer to this evidence directly in response to the Section 42a Report. The Statement of Evidence by Leon Saxon is abbreviated to 'SELN' below.
50. I disagree with the assertion in Paragraph 27.1 of SELN that the 'dripline half height' method is the simpler of the two methods to use. For the reasons given in my evidence in Paragraph 38 in my opinion the '12 times stem diameter' method is the simpler of the two methods to use.

51. In Paragraph SELN 27.2 it is implied that the '12 times stem diameter' method is inappropriate because it is 'based on a tree growing in open space surrounded by homogenous soil'. However, this argument could equally be applied to the 'dripline half height' method. Both methods determine a nominal circular RPA around a tree which takes no account of potential below ground root obstructions such as roads, footpaths, foundations, or roots of other trees which may have modified the root spread of the Notable Tree in question. Mr Saxon's criticisms therefore equally apply to Council's preferred RPA method and I therefore consider them to be unfounded. This matter is covered in more detail my earlier evidence.
52. In SELN Paragraph 27.2 it is stated that 'It is not considered to be a reasonable response to determine an accurate TPZ for each notable tree and represent this in the PDP'. This criticism could again be equally applied to Council's proposed RPA definition. This is because each Notable Tree will have a different RPA using either the 'dripline half height' or '12 times stem diameter' method. This does not need to be determined for each Notable Tree in the District Plan. It is only necessary to outline the method by which the RPA is obtained in the District Plan. I therefore consider this stated criticism to be unfounded. This matter is covered in more detail my earlier evidence.
53. In SELN Paragraph 27.2 it is stated that 'In any event, as the tree continues to grow, the TPZ may require updating, again, unachievable for a council to manage in what is ultimately a static document for 10 years'. Again this criticism could equally apply to Council's preferred RPA method. A RPA does not need to be updated each time a tree grows as this information is not in the District Plan, and only needs to be determined if activities are proposed within the RPA which require resource consent. I therefore consider this criticism to be unfounded. This matter is covered in more detail my earlier evidence.
54. In SELN Paragraph 27.4 it is stated that 'The Standards TREE-S1-3 and TREE-S1-6 refer to the trees 'protected root zone'. This would appear to be a typographical error and should be amended to 'Root Protection Area' to maintain consistency''. As outlined in Paragraph 30 of my Evidence the Australian, British and USA Arboricultural Standards each uses a different term to describe an area of protected roots. These being Tree Protection Zone, Root Protection Area, and Critical Root Zone. The NZ Arboricultural Association prefers the term Tree Protection Zone (as stated on its website) because the NZ and Australian Arb Associations collaborate on many professional arboricultural matters including the development of Arboricultural Minimum Industry Standards (<https://www.nzarb.org.nz/mis>). Both the NZ and Australian Arboricultural Associations support the '12 times stem diameter'

method to determine the Tree Protection Zone/Root Protection Area for a tree where construction is proposed nearby. This matter is covered in more detail my earlier evidence.

55. In SELN Paragraph 27.5 various issues are raised including that *the 'dripline or half height' method does not result in wholesale significant harm to protected trees, and that early engagement with a suitably qualified and experienced arborist is far more important than minor discrepancies between root protection areas*. I believe I have demonstrated in my evidence that the discrepancies between the two methods can be large. In particular, in Paragraph 25 of my Evidence I outlined how a columnar tree could have a much larger RPA than a spreading tree of the same height. These are not minor discrepancies, and for smaller trees the discrepancies would remain. The other problem is that a 20m RPA that Council's methodology could theoretically produce goes way beyond the maximum extent advised by British and Australian Trees and Development Standards of 15 metres. There are times when a developer does not engage a project arborist at the outset and seeks to maximise the potential developable area of a site by undertaking earthworks or construction as close to protected trees as possible. In these situations it is very important the RPAs are of a sufficient size to protect trees.
56. In SELN Paragraph 27.7 an example is provided of protection zones for four similarly sized street trees. In the Figure 3 Photo provided with this paragraph the blue circle around each of the four trees signifies the area of protected roots using the '12 times stem diameter' method, and the orange circle signifies the area of protected roots using the 'dripline half height' method. I do not believe the Council's example of four self-selected street trees of a similar age, size and possibly species is sufficiently representative of a wide range of tree species, sizes, shapes and environmental conditions around Porirua to be able to draw any reliable conclusions from the results. Council's example in Figure 3 appears to show that the 'dripline half height' method produces consistently larger radii of protected roots as compared to the '12 times stem diameter' method. I do not consider the sample to be sufficiently broad or impartially selected for a reliable conclusion to be drawn as to the extent of RPAs regularly produced by the two methods. The selected trees appear to be located quite close to one another, and in such situations trees tend to become partially etiolated with relatively thinner stems. The stems of partially etiolated trees are likely to produce smaller RPAs using the '12 times stem diameter' method. On the basis of providing an example using a self-selected sample of four similar trees I would recommend that Paragraph 27.7 and the accompanying annotated photograph Figure 3 should not be considered reliable evidence. Please also refer to Appendix 5 which applies the two methods to 159 trees of a variety of ages, species, and sizes in Porirua.

57. Mr Saxon refers to advice in one of the International trees and construction standards in Paragraph 32.1 of his Expert Evidence. In this paragraph he refers to the 'modern standard' (presumably AS4970) as a good source of guidance on the RPA encroachment matter to which he is replying, and in this regard he appears to support use of the standard in respect of the '12 times stem diameter' method.

5 SOIL EXTRACTION METHODS WITHIN THE ROOT PROTECTION AREA

58. Council has proposed allowing excavation within the RPA of Notable Trees using the hydrovac soil extraction method. I concur with Council's expert arboricultural consultant that 'hydro-excavations can strip the bark from roots, causing damage to the cambium and therefore the flow of water and nutrients between the roots and the canopy'. Airvac soil extraction methods on the other hand are benign to roots and in my experience do not cause significant damage to them. Mr Saxon also mentions no concerns around the use of airvac around roots and I therefore conclude that he agrees that this is a benign method of soil extraction as regards the potential for root damage. Auckland Council which has the most arborists employed at a management level of all NZ Councils, only allows use of airvac in the rooting areas of protected trees.
59. I am therefore of the opinion that the most appropriate soil extraction method for Council to allow within RPAs is the Airvac or Airspade method, and that consequently reference to the hydrovac method should be removed from the District Plan. The proposed wording is that directional drilling is only permitted below a depth of 1 metre, and a compromise relief would be to also allow hydrovac below 1m depth. If there is any risk to roots as a result of use of a mechanised tool within the RPA then on a precautionary basis that method should not be used, if other suitable methods are available which will accomplish the job as efficiently. I attach in Appendix 4 some more information on hydrovac and airvac and their potential for damaging tree roots. I would therefore recommend all references to hydrovac are removed from the District Plan Notable Trees Chapter.

6 MINIMUM QUALIFICATION LEVEL FOR A TECHNICIAN ARBORIST

60. In regard to the District Plan R3 and R4 requirements to use a L6 qualified arborist, in my opinion I believe that a Level 4 (L4) qualified arborist is able to competently and professionally accomplish all the requirements cited by Council. The L4 qualification trains arborists on

activities such as best arboricultural practice in regard to trimming and pruning of trees, being able to determine if a tree is dead or in decline or unsafe or hazardous branches, hazard analysis, and to be able confirm that tree works are in accordance with good arboricultural practice. The R3 and R4 requirements are all covered as part of a L4 qualification (see [https://www.wintec.ac.nz/study-at-wintec/courses/arboriculture/advanced-horticultural-trades-\(level-4\)-\(arboriculture\)\)](https://www.wintec.ac.nz/study-at-wintec/courses/arboriculture/advanced-horticultural-trades-(level-4)-(arboriculture))) , and a L4 arborist's skillset may well be complemented by on the job experience and achieving additional certifications such as an industry recognised tree risk-assessment method. The R3 and R4 arboricultural knowledge requirements represent arboricultural skills covered by a L4 qualification, and a Level 6 (L6) qualification does not significantly improve on these abilities and is therefore not required to achieve these Council requirements.

61. The L6 qualification covers more advanced arboricultural knowledge in areas such as tree identification, landscape planning, biomechanics, and pests and diseases, but being able to prune a tree and recognise if a tree is dead, unsafe, or in decline is basic arboricultural knowledge which a L4 qualified arborist would already possess.
62. The only module of the L6 qualification covered in more detail than the L4 qualification is Hazard Tree Assessment. I therefore consider that as long as a L4 qualified arborist also has a current recognised Tree Risk Assessment Certification such as TRAQ, QTRA, or VALID then they should have adequate knowledge and expertise to accurately determine what constitutes an unsafe, hazardous, or dead tree or part of a tree.
63. It would be onerous and expensive for a tree owner or manager to have to engage a Level 6 Arborist to sign off on or provide a report on whether for instance a tree is dead, when this can be determined just as well by a Level 4 arborist.
64. In my opinion examples of instances when a Level 6 qualified arborist should be required are to undertake a Tree Survey, Tree Impact Assessment, or Arboricultural Method Statement. For example, if works are proposed within the RPA of a Notable Tree an Arb Method Statement pertaining to these proposed works should be completed by a Level 6 Arborist. In my opinion all works within the RPA of a Notable Tree should be a Discretionary Activity so that an Arb Method Statement can be produced by a L6 arborist if required by Council. Many Councils make all works within the RPA discretionary and I have seen damage caused to tree roots multiple times, undertaken by roading crews who do not have the knowledge or time to do the work in accordance with the permitted standards.

7 CHOOSING A SUITABLE STEM THRESHOLD

65. Having read through the Mr Saxon's expert evidence and response to my queries I am satisfied that Council took a best practice approach to determining a suitable STEM threshold. The examples and annotated photographs provided in Mr Saxon's Evidence demonstrate that a robust approach was taken to evaluating trees, and balancing high and low scores and condition to arrive at a sensible STEM threshold. I therefore now concur with Council's chosen STEM threshold.

8 PERMITTED ACTIVITIES WITHIN THE ROOT PROTECTION AREA

66. Many Councils make all works within the RPA discretionary, for example Taupo Council. Personally I have seen much damage caused to tree roots multiple times, often undertaken by roading crews who do not have the information, knowledge or time to do the work in accordance with the permitted standards. Often big roading firms pick up contracts to lay road, install underground services, or dig holes under trees. Sometimes these works are sub contracted out to businesses that are not aware of tree protection rules, sometimes the person on the digger isn't aware, sometimes they are aware but don't take the contract requirements to do with tree root protection seriously. There are all sorts of reasons why this often doesn't work and trees are damaged.
67. Requiring oversight of permitted works within the RPA by a L6 arborist may not prevent very serious damage to the roots of a Notable Tree. For instance where the root system of the tree is very restricted it may not be appropriate to undertake any root severance or excavation at all as the roots removed or damaged may represent a large proportion of the roots that exist. In the Appendix 3 photograph I show a Notable Tree in Porirua surrounded on all sides by structures and hard surfaces and there is only a very small area for roots to grow unrestricted. This is a good example of where permitted activities would likely damage a large amount of roots if undertaken as a permitted activity. Hand digging and hydrovac could severely damage remaining roots. This is why it is important that in each individual case an assessment is undertaken of the ability of the tree to withstand root loss and damage.
68. Some trees are highly sensitive to any root loss and suffer dieback or disease as a result, whilst some trees are highly tolerant of root loss and disturbance. This is another reason why each proposal to undertake excavation or pruning to the roots of a Notable Tree should be judged on its merits, and on the basis of adequate mitigation.

69. In my experience digging with hand tools can also cause significant damage to tree roots. A spade is just not small enough often to get between a knot of roots and often roots are damaged with the first digging action when roots are inadvertently hit when expecting soft ground. Within the RPA it is always best to use an air spade or air vac, and potentially a small spade, trowel or claw can be used to make small holes for undertaking root health or presence excavations.
70. Allowing roots which are 35mm or less to be able to be removed as a permitted activity has the potential to cause significant damage to a Notable Tree. As roots get further away from a tree they generally reduce in size and 4 or 5 metres away from the main trunk (depending on tree size) may mainly be 35mm or less in diameter. These roots may still have importance in respect of both the structural integrity of the tree and its health. By allowing roots of 35mm or less to be removed as a permitted activity could lead to the loss of 20% of a tree's roots in some circumstances which exceeds the 10% limit Council has set as the maximum amount that may be able to be removed. This may be particularly the case if the root system is one sided perhaps because its next to a road where root growth is restricted, or if on a hillside. Roots could also be ripped and torn which are 35mm or less as a permitted activity within the RPA, and this can allow fatal disease into a tree such as phytophthora or honey fungus.

9 SUMMARY TABLE OF RELIEF SOUGHT

Issue	Relief sought	Compromise relief
Definition of RPA	Definition: The RPA shall be calculated in accordance with the requirements of the most current version of Australian Standard 4970 - Protection of Trees on Development Site, and/or the equivalent NZ/AUS Minimum Industry Standard	Definition: The radius of the RPA is calculated by multiplying its diameter measured at a height of 140cm by 12. The minimum RPA radius is 200cm and the maximum is 1500cm.
Use of hydrovac within RPA	Hydrovac is not allowed within the RPA of a Notable Tree	Hydrovac is permitted below the known rooting depth of a tree, typically below 1 metre
Hand digging within the RPA	This is not allowed apart from for small exploratory holes using a trowel or small spade undertaken by a L6 qualified arborist	
Permitted activities within the RPA	All activities within the RPA area a Discretionary activity. Generally a L6 arborist will be required to prepare an Arb Method Statement to cover proposed works and require adequate mitigation if allowed. All works within the	All activities within the RPA area are a Restricted Discretionary activity. A L6 arborist will be required to prepare an Arb Method Statement to cover proposed works and require

	RPA to be supervised or undertaken by a L6 arborist	adequate mitigation if allowed. All works within the RPA to be undertaken in accordance with approved arborist report and supervised or undertaken by a L6 arborist (matters of discretion to be altered so hand digging, hydro vac, and roots 35mm below are also removed)
Minimum Arborist qualifications required to confirm specific tree conditions	A L4 qualified arborist holding a current tree risk certification such as TRAQ, QTRA, or VALID may make a determinations as to whether a tree or any of its parts are dead or dangerous such that the tree or parts of can be removed as a permitted activity.	
10% reduction of RPA is considered a minor encroachment	Discretionary activity: RPA has the potential to be reduced by up to 10% dependent upon the advice and any offset proposed by a L6 qualified arborist.	
Table 1 – Relief sought		

APPENDICES

Appendix 1 – BS5837 1991 tree and root protection methods

Appendix 2 – Examples of Councils using the BS5837 1991 root protection method including the 'whichever is greater' caveat in their District Plans

Appendix 3 – Example of Notable Tree in Porirua with large RPA

Appendix 4 – Hydrovac versus Airvac information/advertorial from Tree Matters magazine (NZ arb association) 2020

Appendix 5 - Spreadsheet – RPAs compared for 159 trees in Porirua against 'dripline or half height' or '12 times stem diameter methods.